

WHAT IS CLAIMED:

1. A photosensitive printing element for preparing flexographic printing plates comprising at least the following layers in the order of:

(a) a support,

(b) a photopolymerizable layer comprising an elastomeric composition sensitive to non-infrared actinic radiation, said layer being soluble, swellable or dispersible in a liquid developer prior to exposure to said non-infrared actinic radiation,

(c) at least one layer comprising an infrared radiation sensitive thermographic material which provides increased image density at the wavelengths in the electromagnetic region of said non-infrared radiation sensitivity upon exposure to infrared laser radiation sufficient to prevent polymerization of the layer (b) during the U.V. exposure, and the at least one layer changes permeability to oxygen upon exposure to infrared radiation or changes permeability upon exposure to radiation.

2. The photosensitive printing element of claim 1 wherein the at least one layer changes permeability to oxygen upon exposure to infrared radiation and the at least one layer comprises a thermographic layer comprising a binder, a light-insensitive reducible silver source, and a reducing agent for silver ion

3. The photosensitive element of claim 2 wherein the at least one layer changes permeability to oxygen upon exposure to infrared radiation and said (c) at least one layer provides an image density of at least 3.0 when exposed to infrared radiation between 750 and 850 nm at a fluence of 1.0 Joules/cm² for less than 1 minute.

4. The photosensitive element of claim 1 wherein the at least one layer changes permeability to oxygen upon exposure to infrared radiation and layer (c) comprises a thermographic layer comprising a binder, a light-insensitive reducible silver source comprising a silver salt of an organic acid, and a reducing agent for silver ion.

5. The photosensitive element of claim 2 wherein the at least one layer changes permeability to oxygen upon exposure to infrared radiation and layer (c) comprises a thermographic layer comprising a binder, a light-insensitive reducible silver source comprising a silver salt of an organic acid, and a reducing agent for silver ion.

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6. The photosensitive element of claim 5 wherein said reducible silver source comprises a silver salt of a fatty acid.

7. A flexographic precursor comprising

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- a. a support,
- b. an ultraviolet photopolymerizable layer coated upon the support and
- c. a thermally imageable layer coated upon said ultraviolet polymerizable layer, said thermally imageable photomask layer having a gas permeability that can be changed by an imaging process.

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8. The flexographic precursor of claim 7 wherein the thermally imageable layer coated upon said ultraviolet polymerizable layer is a thermally imageable photomask layer having a permeability to gas that changes when imaged by thermal energy.

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9. The flexographic precursor of claim 7 wherein the gas permeability can be changed by an infrared imaging process.

10. The flexographic precursor of claim 7 wherein the gas permeability can be changed by an illumination imaging process.

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11. The flexographic precursor of claim 10 wherein the illumination is thermally imaged illumination.

12. The flexographic precursor of claim 7 wherein the thermally imageable photomask layer comprises more than one layer.

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13. A method for making a flexographic printing plate, said method comprising
- a. providing a support, the support having coated thereon an ultraviolet photopolymerizable layer and a thermally imageable photomask layer on top of said ultraviolet photopolymerizable layer, the thermally imageable photomask layer having an oxygen permeability that is altered by an imaging process, and
 - b. imagewise changing opacity of said thermally imageable photomask layer to ultraviolet radiation by exposing the thermally imageable photomask layer to radiation from a laser.

14. The method of claim 13 wherein the gas permeability of the thermally imageable layer is altered by the exposure to radiation from a laser.

15. A method for making a flexographic printing plate, said method comprising
- a. providing a support, the support having coated upon it an ultraviolet photopolymerizable layer and a thermally imageable photomask layer directly on top of said ultraviolet photopolymerizable layer,
 - b. providing a specific range of oxygen permeability in the thermally imageable photomask layer and
 - c. imagewise changing opacity of said thermally imageable photomask layer to ultraviolet radiation using infrared radiation from a laser.

16. The method of claim 15 wherein the exposure to infrared radiation from a laser changes the oxygen permeability of said thermally imageable photomask layer and thereby imagewise changing the opacity of said thermally imageable layer to ultraviolet radiation.

17. The method of claim 13 wherein the thermally imageable photomask layer comprises more than one layer.

18. The method of claim 15 wherein wherein the thermally imageable photomask layer comprises more than one layer.

19. The method of claim 16 wherein wherein the thermally imageable photomask layer comprises more than one layer.

20. A method for making a flexographic printing plate, said method comprising

- a) providing a support, the support having coated upon it an ultraviolet photopolymerizable layer and an imageable photomask layer directly on top of said ultraviolet photopolymerizable layer,
- b) providing a specific range of oxygen permeability in the thermally imageable photomask layer that is sufficient to allow oxygen to diminish the photopolymerization rate of the ultraviolet photopolymerizable layer;
- c) imagewise changing opacity of said thermally imageable photomask layer to ultraviolet radiation using imagewise exposure to radiation;
- d) exposing the photomask layer to UV radiation to expose the ultraviolet photopolymerizable layer;
- e) removing the photomask layer; and
- f) developing the exposed ultraviolet radiation polymerizable layer to provide an image.

21. The method of claim 20 wherein highlight dots of less than 10% or produced with the top quarter of the dot being cylindrical in shape, with less than 15% variation in thickness in that top quarter.

22. A backside exposable photosensitive printing element for preparing flexographic printing plates comprising at least three layers in the orders of:

- (a) a transparent support,

- b. an ultraviolet photopolymerizable layer coated upon said dimensionally stable base and
- c. a thermally imageable layer coated upon said ultraviolet polymerizable layer, said thermally imageable photomask layer having a gas permeability that can be changed by an imaging process.

23. The method of claim 13, wherein the photomask layer comprises two layers, one layer altering opacity upon exposure and the other layer altering free radical or oxygen permeability upon the same exposure.

24. A photosensitive printing element for preparing flexographic printing plates comprising at least the following layers in the order of:

- (a) a support,
- (b) a photopolymerizable layer comprising an elastomeric composition sensitive to non-infrared actinic radiation, said layer being soluble, swellable or dispersible in a liquid developer prior to exposure to said non-infrared actinic radiation,
- (c) at least one layer comprising an radiation sensitive material that is opaque to UV radiation before imagewise exposure and becomes transmissive of UV radiation after imagewise exposure sufficient to allow polymerization of the layer (b) during the U.V. exposure, and the at least one layer has sufficient permeability to free radicals or oxygen to enable a reduction of the rate of polymerization of layer (b) when exposed to standard ambient conditions.

25. A photosensitive printing element for preparing flexographic printing plates comprising at least the following layers in the order of:

- (a) a support,
- (b) a photopolymerizable layer comprising an elastomeric composition sensitive to non-infrared actinic radiation, said layer being soluble, swellable or dispersible in a liquid developer prior to exposure to said non-infrared actinic radiation,

(c) at least one layer comprising an radiation sensitive material that is transmissive to UV radiation before imagewise exposure and becomes opaque to UV radiation after imagewise exposure sufficient to prevent polymerization of the layer (b) during the U.V. exposure, and the at least one layer has sufficient permeability to free radicals or oxygen to enable a reduction of the rate of polymerization of layer (b) when exposed to standard ambient conditions.

26. The photosensitive printing element of claim 25 wherein the at least one layer comprises two layers wherein only one layer becomes opaque and the two layers each sufficient permeability to free radicals or oxygen to enable a reduction of the rate of polymerization of layer (b) when exposed to standard ambient conditions.

27. A photosensitive printing element for preparing flexographic printing plates comprising at least the following layers in the order of:

(a) a support,

(b) a photopolymerizable layer comprising an elastomeric composition sensitive to non-infrared actinic radiation, said layer being soluble, swellable or dispersible in a liquid developer prior to exposure to said non-infrared actinic radiation,

(c) at least one layer comprising a radiation sensitive material that is transmissive to UV radiation before imagewise exposure and becomes opaque to UV radiation after imagewise exposure to actinic radiation, the opaque property being sufficient to prevent polymerization of the layer (b) during the U.V. exposure underneath opaque areas, and the at least one layer has sufficient permeability to free radicals or oxygen to enable a reduction of the rate of polymerization of layer (b) when exposed to standard ambient conditions.

28. A photosensitive printing element for making a flexographic printing plate, said method comprising

- a) a support having coated upon it an ultraviolet photopolymerizable layer and an imageable photomask layer directly on top of said ultraviolet photopolymerizable layer,
- b) the thermally imageable photomask having a range of oxygen permeability in the thermally imageable photomask layer that is sufficient to allow oxygen to diminish the photopolymerization rate of the ultraviolet photopolymerizable layer upon standing at room temperature and standard pressure in air.

29. A method for making a flexographic printing plate, said method comprising

- a) providing a support, the support having coated thereon an ultraviolet photopolymerizable layer and a thermally imageable photomask layer on top of said ultraviolet photopolymerizable layer, the ultraviolet photopolymerizable layer having a photopolymerization rate that is reduced upon exposure to oxygen and a thermally imageable photomask layer having an oxygen permeability, and
- b) allowing oxygen to permeate through the imageable photomask layer to reduce the photopolymerization rate of the photopolymerizable, and
- c) imagewise changing the developability of the thermally imageable photomask layer by exposing the thermally imageable photomask layer to radiation from a laser.